SUMITOMO RECOMMENDED PROCEDURE

SRP SP-F04-033

FutureFLEX® AIR-BLOWN FIBER® SOLUTIONS

SEALING PROCEDURES FOR FUTUREFLEX TUBES LOCATED IN CLASS I, DIVISION 1 & 2 ENVIRONMENTS

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1.0 General

1.1 This procedure describes the special techniques to seal empty and filled FutureFLEX Air-Blown Fiber (ABF) tubes to prevent the transfer or passage of flammable gases or vapors from (hazardous) Class I, Division 1 & 2 areas to (non-hazardous) Non-Classified areas. Refinery facilities are typical Class I environments.

Note: *Special techniques to seal tube cable ends are described in Sumitomo Recommended Procedure, Sealing Procedures For FutureFLEX Tubes Cables Located In Class I, Division 1 & 2 Environments, SRP SP-F04-032.*

1.2 Hazardous (Classified) locations are defined as those areas where fire or explosive hazards may exist due to the presence of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings. (Consult the NEC for more detailed descriptions / definitions.)

1.2.1 Class I hazardous locations are defined as those areas in which flammable gases or vapors are or may be present in the air in sufficient quantities to produce explosive or ignitable mixtures. Petroleum refinery facilities are typical Class I locations.

1.2.2 Division 1 locations are defined as those areas where flammable gases or vapors may be present due to normal everyday operations.

1.2.3 Division 2 locations are defined as those areas where flammable gases or vapors may be present due to abnormal conditions caused by an accidental failure, rupture, or breakdown.

1.3 Tube sealing procedures shall take place at the designated Class I boundary of the facility. This point or location must be specified by appropriate authority such as the Refinery's Safety Department.

1.4 Tube sealing procedures sealing procedures will normally be accomplished inside an appropriately rated Tube Distribution Unit (TDU) such as a pedestal- or wall-mounted NEMA-4 or -4X outdoor enclosure.

1.5 One person can perform this procedure.

2.0 Safety Precautions

2.1 The use of safety equipment (safety glasses and gloves) is recommended during this installation procedure.

3.0 Reference Documents

3.1 Sumitomo Recommended Procedure, *FutureFLEX Tube Pressure Testing Procedure*, SRP SP-F04-003.

3.2 Sumitomo Recommended Procedure, *FutureFLEX Tube Obstruction Testing Procedure*, SRP SP-F04-004.

3.3 Sumitomo Recommended Procedure, *FutureFLEX Fiber Bundle Installation Procedure,* SRP SP-F04-002.

3.4 Sumitomo Recommended Procedure, *Sealing Procedures for FutureFLEX Tube Cables Located in Class I, Division 1 & 2 Environments,* SRP SP-F04-032.

4.0 Equipment / Tools Required

The following equipment, tools, and materials are required to complete this procedure:

4.1 Tubing Cutter (BETC001).

4.2 Tube Cap (DE08MA).

4.3 Gas Blocking Coupling (DE08GBC).

5.0 Equipment Layout

5.1 **See Fig. 1** for a typical equipment layout of a 7-tube cable with its empty tubes sealed with Tube Caps and its tubes filled with fiber bundle sealed with Gas Blocking Couplings.

6.0 Sealing Empty Tubes with a Tube Cap

6.1 Once individual tubes are exposed inside the Class I boundary Tube Distribution Unit (TDU), they must be sealed to keep out contamination and to establish an effective gas blocking seal.

6.2 After the tube cable is installed through Kellems® Grip (refer to SRP SP-F04-032), leave tube length long; do not cut short at this time.

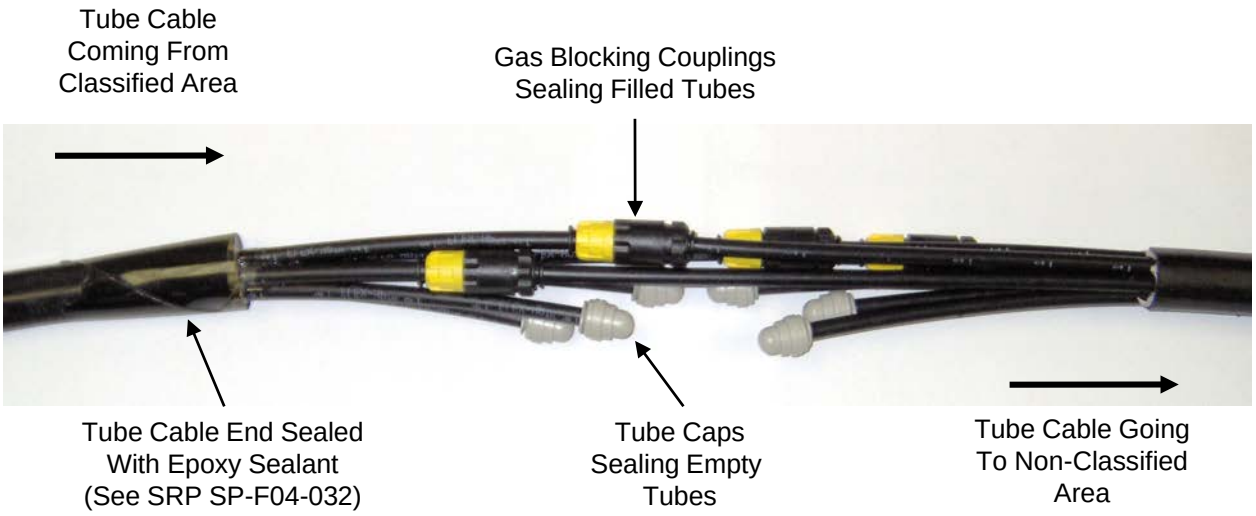

Figure 1
Equipment Layout Depicting Tube Sealing / Gas Blocking Techniques
At Class I, Division 1 & 2 Boundary Locations

6.3 Use Tubing Cutter to trim / clean cut ends of all incoming and outgoing tubes. Install Tube Caps on all exposed tubes. The Tube Cap is a push-fit device so ensure it is fully seated and firmly attached to the tube end. **See Fig. 2.**

6.4 Tube Caps shall remain installed on all incoming and outgoing tubes located inside the Class I boundary TDU until just before a fiber bundle installation is performed. At that time, the Tube Cap shall be removed and replaced with a Gas Blocking Coupling.

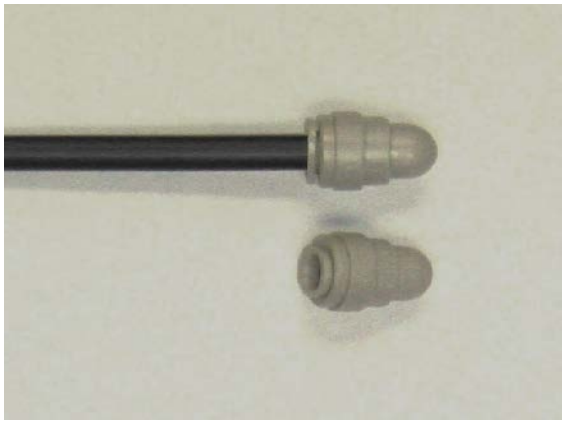

Figure 2
Tube Cap to Seal
Empty Tubes

7.0 Sealing Filled Tubes with a Gas Blocking Coupling

7.1 The Gas Blocking Coupling is a special push-fit coupling designed to connect standard 8mm OD tubes. When properly installed, it provides an internal gas blocking seal around an installed 2mm OD or 3mm OD fiber bundle. **See Fig. 3.**

7.2 The yellow Tube Lock End of the Gas Blocking Coupling must be attached to the tube coming from the Classified area.

7.2.1 When the yellow Tube Lock End is unscrewed (loosen), the coupling can be push-fit onto the tube like any standard Tube Coupling.

7.2.2 After the Gas Blocking Coupling is installed, the Installer must then screw down (finger-tight only) the yellow Tube Lock End to positively "lock" the coupling to the tube.

7.3 The black Sealing Adjustment End of the Gas Blocking Coupling must be attached to the tube going to the Non-Classified area.

7.3.1 When the black Sealing Adjustment End is unscrewed (loosen), the coupling's internal Sealing Washer is moved to its full open position providing a 6mm ID internal passage through the coupling. In this condition, the Gas Blocking Coupling functions like a standard Tube Coupling and will allow any 2mm or 3mm OD fiber bundle to be blown through it.

7.3.2 After fiber bundle has been installed, the black Sealing Adjustment End must be screwed down (finger-tight only) to collapse or compress the internal Sealing Washer around the installed fiber bundle. This step is critical as it creates the effective gas blocking seal around the installed fiber bundle without damaging / affecting the optical strands.

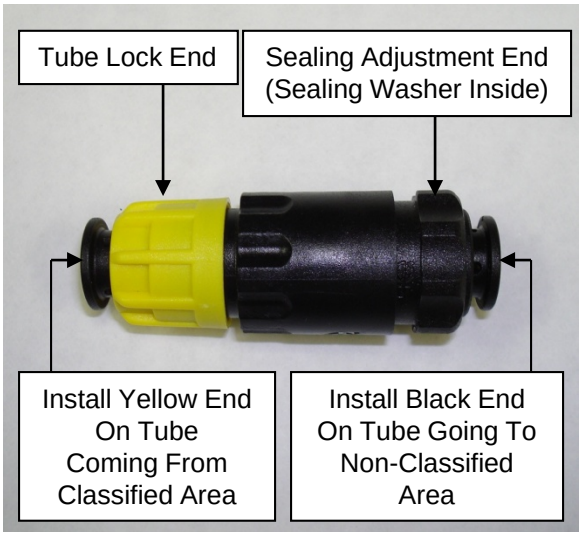

Figure 3
Gas Blocking Coupling for Sealing Filled Tubes

8.0 Testing Tube Cables in Classified Areas

8.1 After tube cables have been properly installed and tube cable ends sealed inside a Class I boundary TDU, all tubes must be pressure and obstruction tested.

8.2 Normally, tube testing is performed on a tube cable span using an end-to-end test method. This requires that incoming and outgoing tubes within TDUs be coupled with standard Tube Couplings to complete the span.

8.3 However, for tube cables installed in Classified areas, it is most critical that a gas blocking seal be maintained at all times. This requires that all empty tubes located inside a Class I boundary TDU be sealed with Tube Caps and not coupled.

8.4 Therefore, pressure and obstruction testing must be accomplished on tube cable segments instead of on tube cable spans.

8.5 Refer to Sumitomo Recommended Procedures, *FutureFLEX Tube Pressure Testing Procedure*, SRP SP-F04-003 and *FutureFLEX Tube Obstruction Testing Procedure*, SRP SP-F04-004 and perform standard tube testing techniques as described with the following exceptions.

8.6 Test all tubes in the tube cable segment installed between the Classified area and the Class I boundary TDU.

8.6.1 Remove Tube Caps and conduct tests.

8.6.2 After testing is complete, re-install Tube Caps to re-seal empty tubes in this tube cable segment.

8.7 Test all tubes in the tube cable segment installed between the Class I boundary TDU and the Non-Classified area.

8.7.1 Remove Tube Caps and conduct tests.

8.7.2 After testing is complete, re-install Tube Caps to re-seal empty tubes in this tube cable segment.

9.0 Installing Gas Blocking Couplings

9.1 A Gas Blocking Coupling is ineffective as a sealing device until a fiber bundle is installed through it and the black Sealing Adjustment End is screwed down around the bundle.

9.2 **Key Point:** Installation of a Gas Blocking Coupling between the incoming and outgoing tubes inside the Class I boundary TDU must be delayed until just before a fiber bundle is to be installed in that tube span.

9.3 Remove Tube Caps from incoming and outgoing tubes.

9.4 Determine final position of Gas Blocking Coupling within TDU and use Tubing Cutter to trim / flush-cut ends of tubes to length as required.

9.5 Unscrew (loosen) yellow Tube Lock End of Gas Blocking Coupling and push-fit it onto tube coming from the Classified area first. Ensure coupling is fully seated and firmly attached to the tube.

9.6 Screw yellow Tube Lock End down onto tube (finger-tight only) to positively "lock" Gas Blocking Coupling to the tube.

Note: *To disconnect a Gas Blocking Coupling from a tube, the yellow Tube Lock End must be unscrewed (loosen) in order for the push-fit feature to release.*

9.7 Unscrew (loosen) black Sealing Adjustment End of Gas Blocking Coupling and push-fit it onto tube going to the Non-Classified area. Ensure coupling is fully seated and firmly attached to the tube.

9.8 Do not screw down (tighten) black Sealing Adjustment End at this time. Verify Sealing Adjustment End is unscrewed so the internal Sealing Washer is in its full open position.

Important Installation Note: *To avoid damaging / unseating O-ring seals inside Gas Blocking Couplings during tube insertion, always: 1) ensure tube ends have a straight, clean cut and 2) ensure tubes are inserted straight and carefully. Do not force tube into coupling. Tube insertion should be fairly easy. If abnormal resistance is felt during tube insertion, stop, remove tube, and inspect O-ring inside coupling. Visually inspect and verify O-ring is still properly seated / in place.*

9.8 **Important Step** - Verify yellow Tube Lock End is screwed down finger-tight and black Sealing Adjustment End is fully open. Failure to do so may result in a failed Obstruction Test and / or damaged fiber bundle.

10.0 Final Tube Testing and Installation of Fiber Bundle

10.1 With Gas Blocking Coupling installed and its black Sealing Adjustment End verified to be fully open, perform final pressure and obstruction tests on the tube span to be immediately filled with fiber bundle.

10.2 Perform standard tube testing techniques as described in Sumitomo Recommended Procedures, *FutureFLEX Tube Pressure Testing Procedure*, SRP SP-F04-003 and *FutureFLEX Tube Obstruction Testing Procedure*, SRP SP-F04-004 on the entire tube span (end-to-end testing).

Note: *If leakage is experienced at the Gas Blocking Coupling, adjust yellow Tube Lock and black Sealing Adjustment Ends slightly to try to stop leakage. If leakage cannot be stopped, remove defective coupling, and replace with a new Gas Blocking Coupling.*

10.3 After the tube span has been successfully tested, install fiber bundle per standard fiber bundle installation procedures. Refer to Sumitomo Recommended Procedure, *FutureFLEX Fiber Bundle Installation Procedure,* SRP SP-F04-002.

10.4 **Important Step** – After the fiber bundle has been installed, an Installer must go back and screw down (finger-tight only) the black Sealing Adjustment End of the Gas Blocking Coupling. *This step is critical to establish the gas blocking seal around the installed fiber bundle.*